



Argonne VERITAS Group

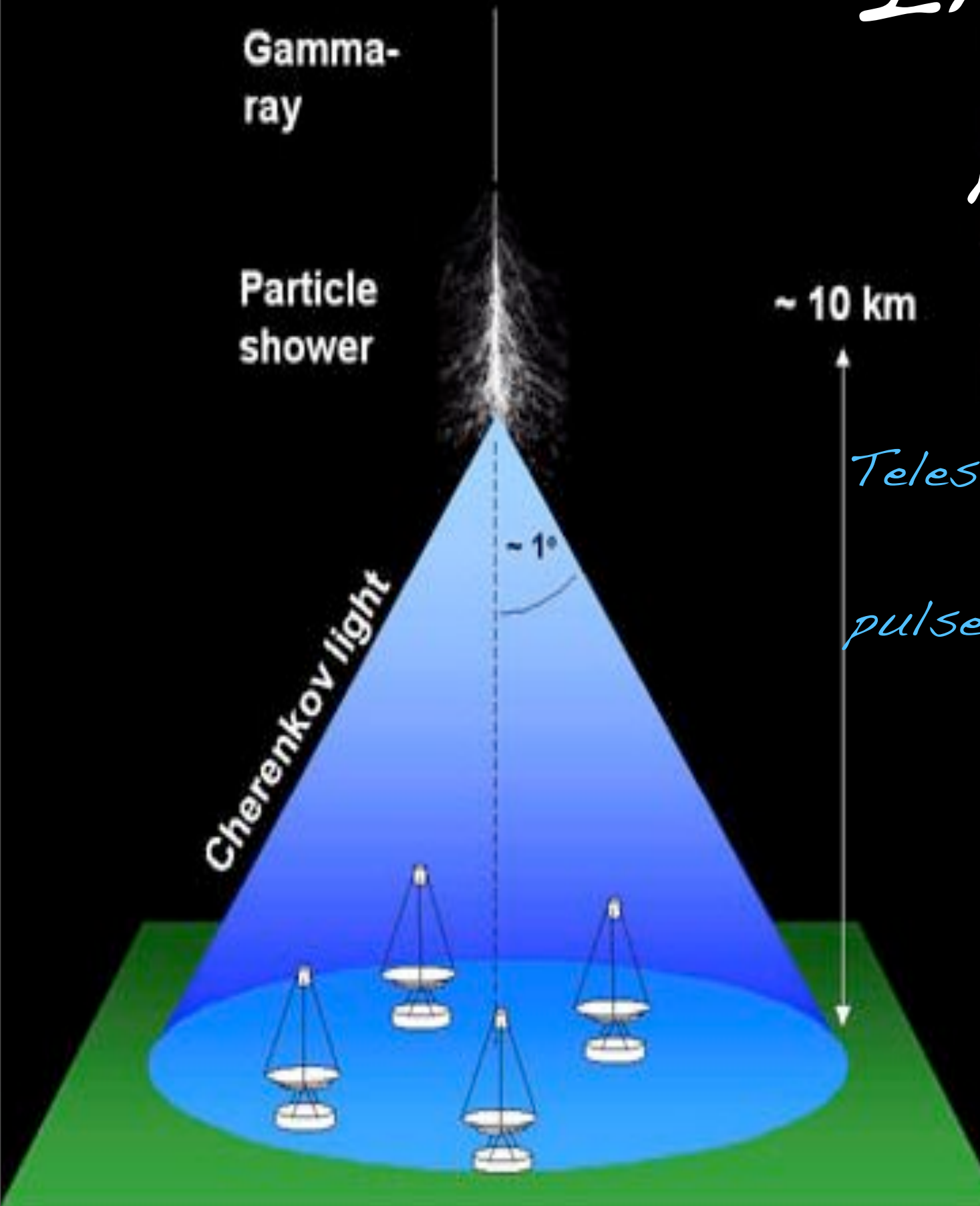
Recent Work

Andrew W. Smith



IACT Array

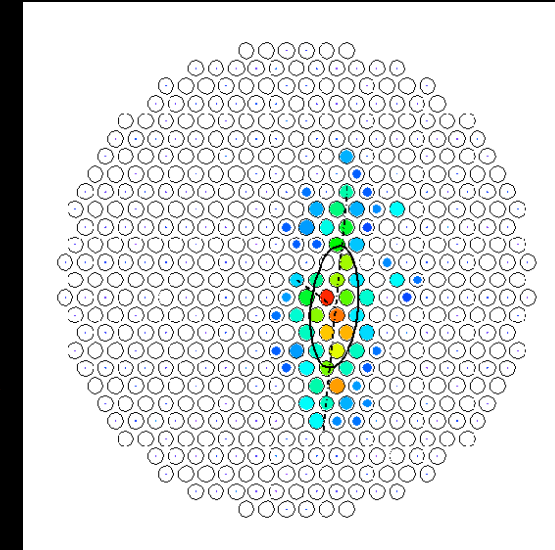
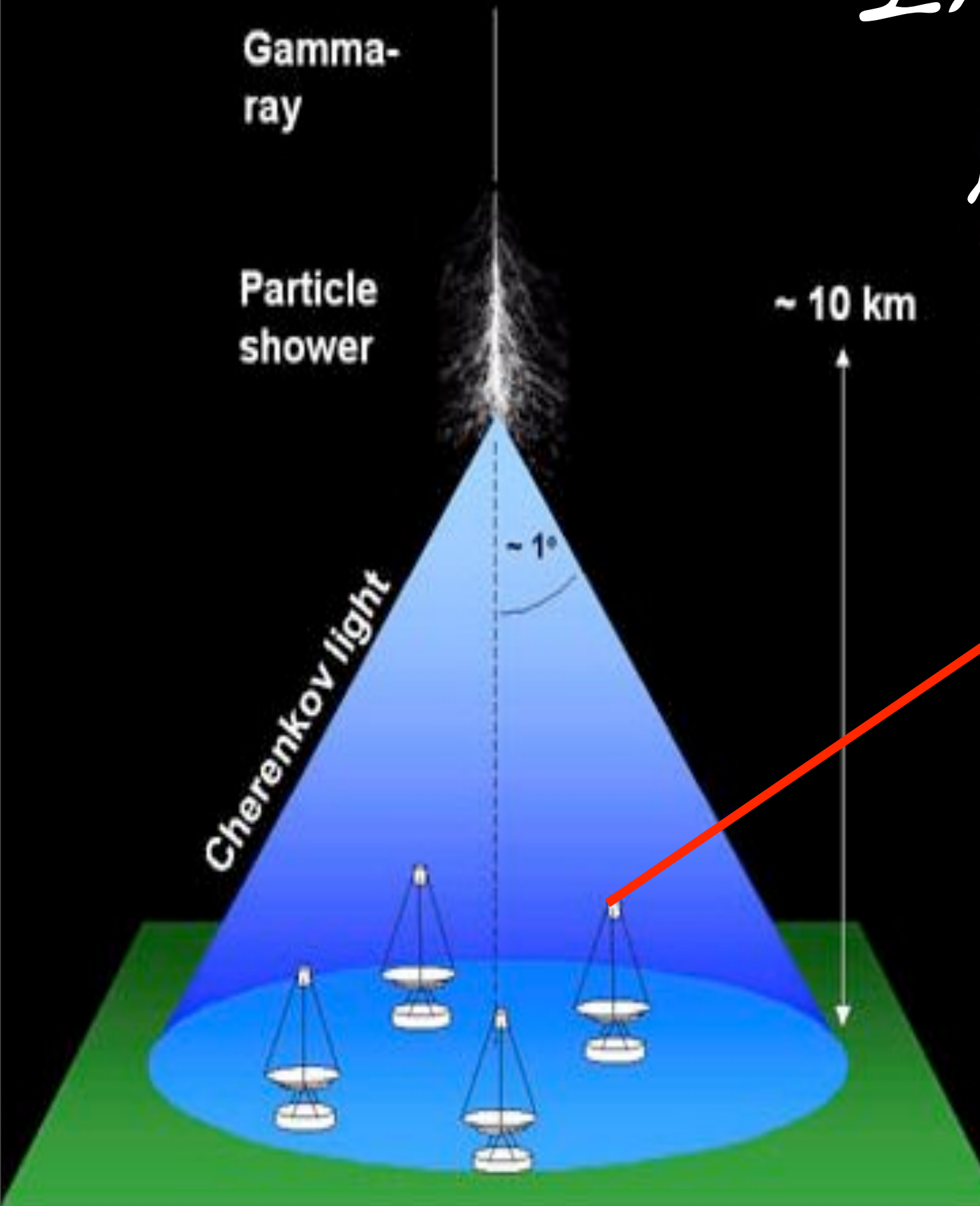
Principle



*Telescopes on ground capture brief
(~6ns)
pulses of UV light from gamma-ray
induced
air showers.*

IACT Array

Principle



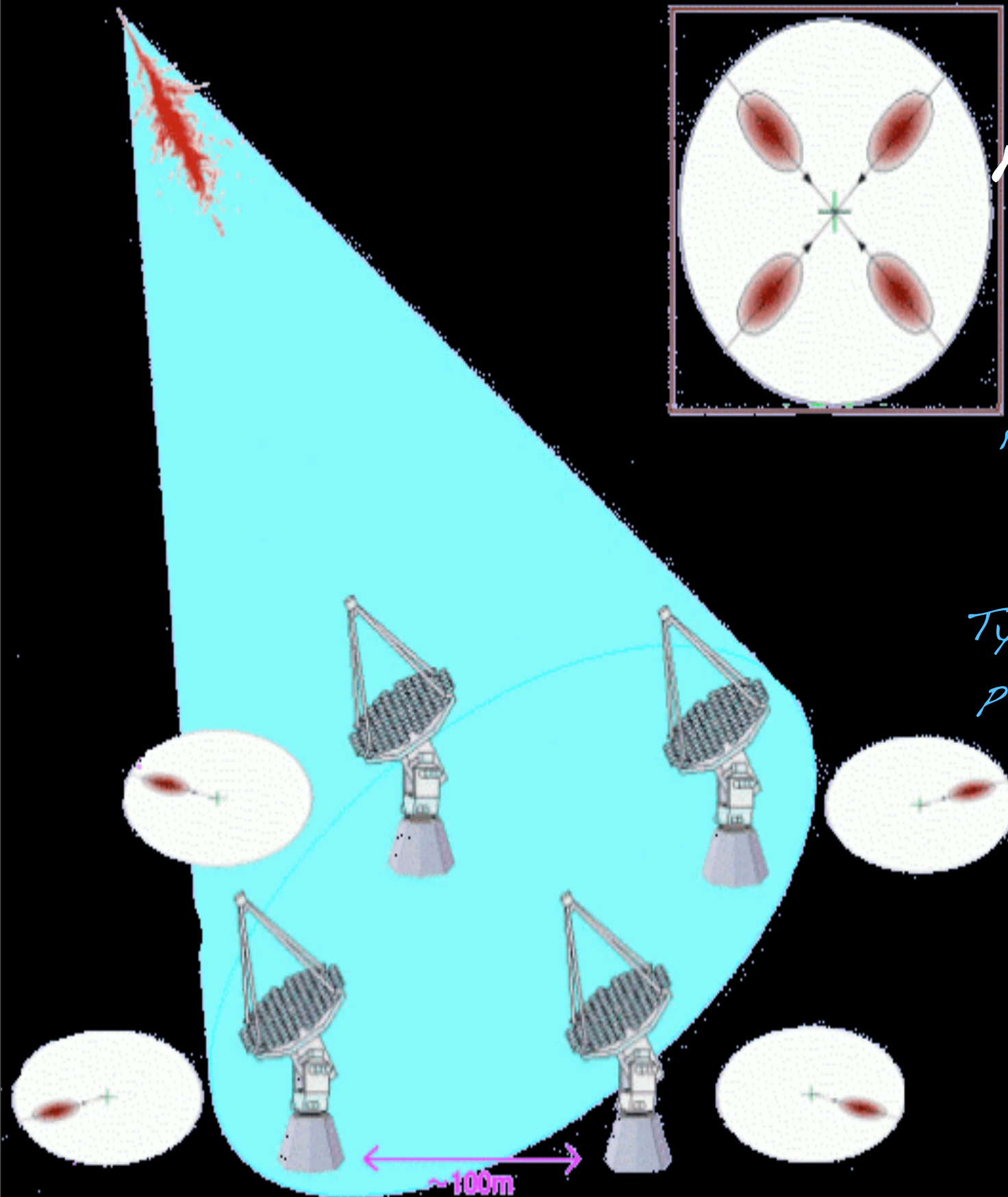
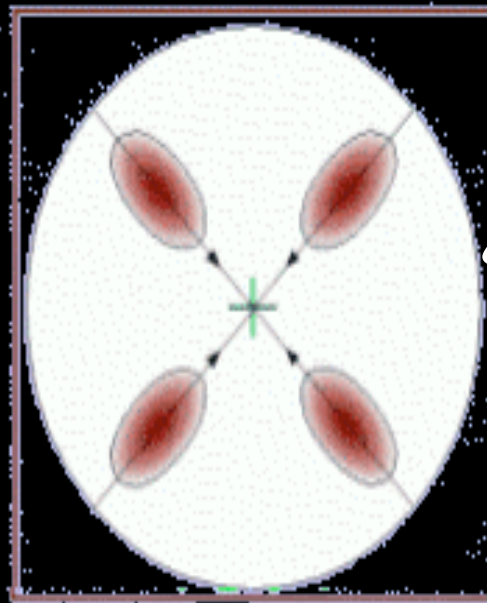
*Pixelated cameras capture
entire
development of air shower*

IACT Array

Principle

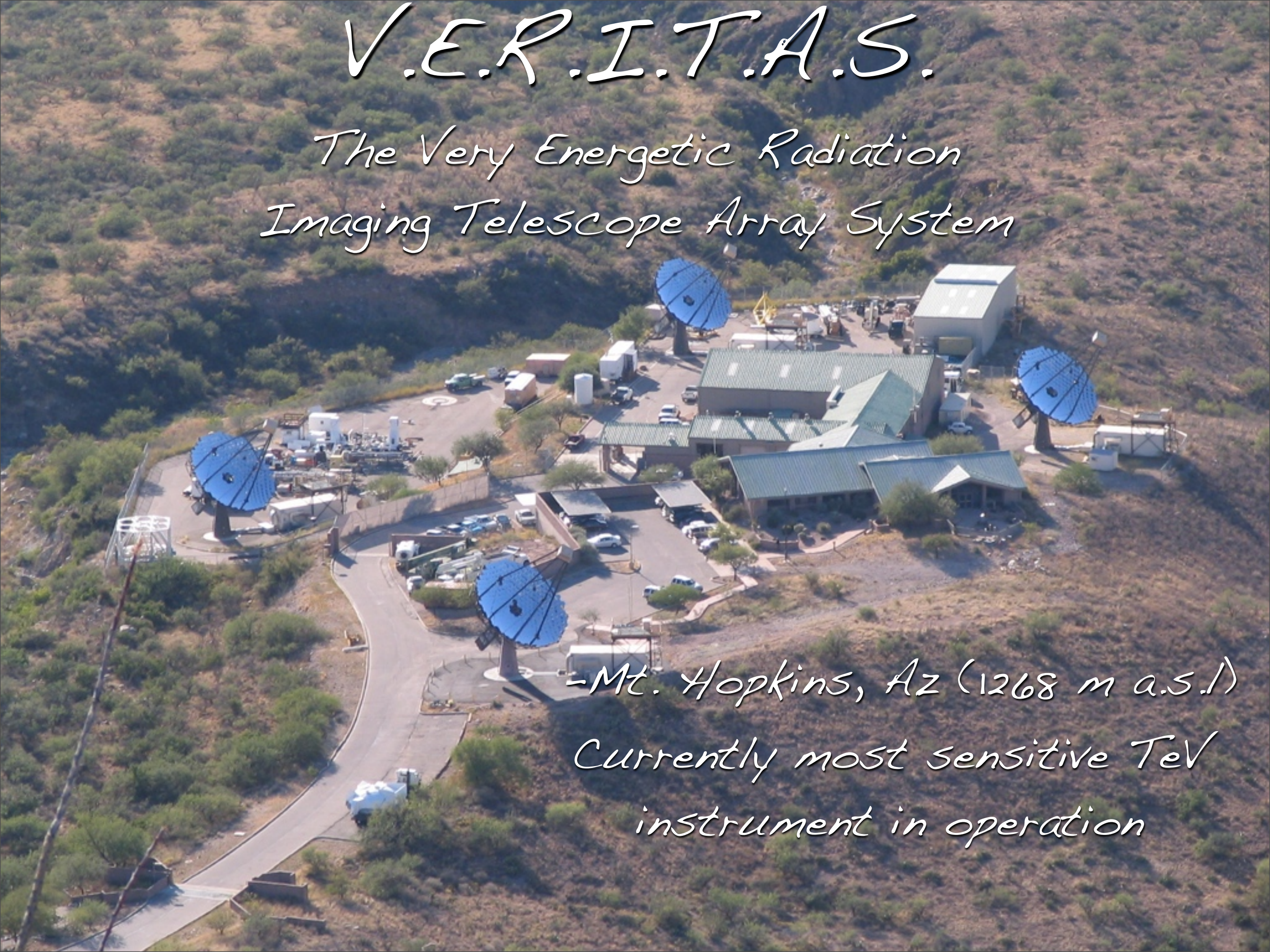
Multiple telescope image of the same air shower allow for very accurate reconstruction of original gamma ray's trajectory.

Typical showers result in Cherenkov light pool of diameter 120m. Since telescopes need only sample part of the pool, effective area of ground based TeV observatories $\sim 10^4 - 10^5 \text{ m}^2$!



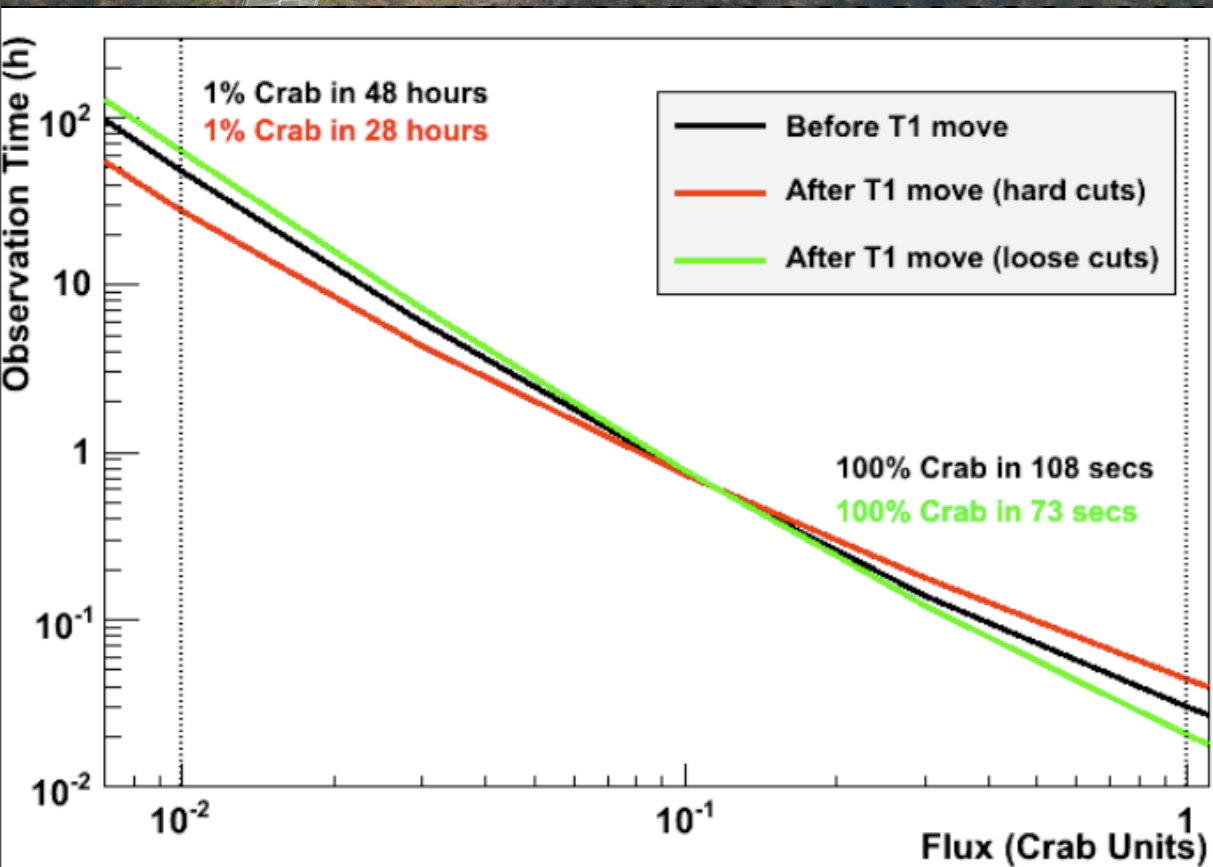
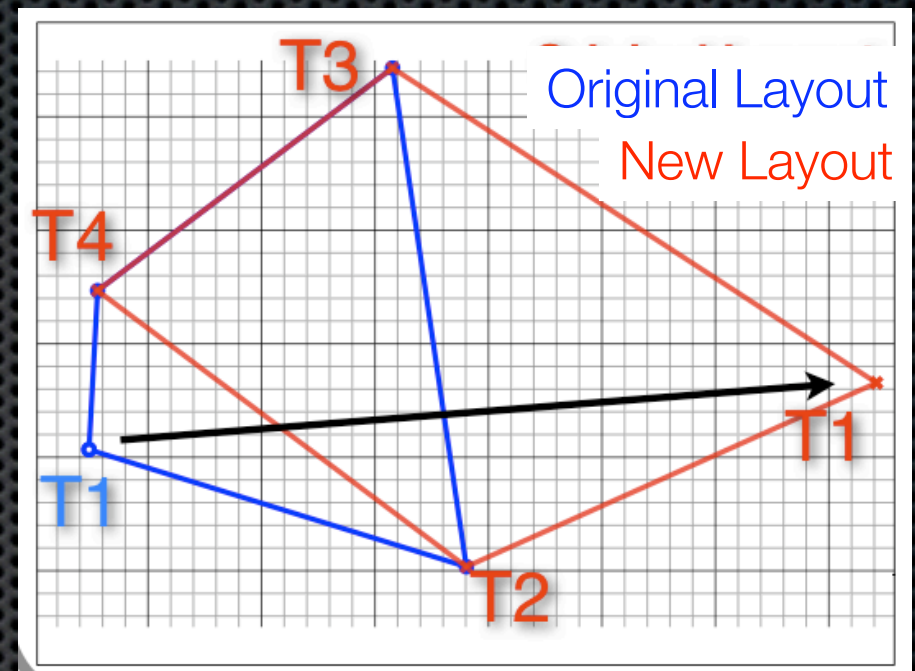
VERITAS.

*The Very Energetic Radiation
Imaging Telescope Array System*



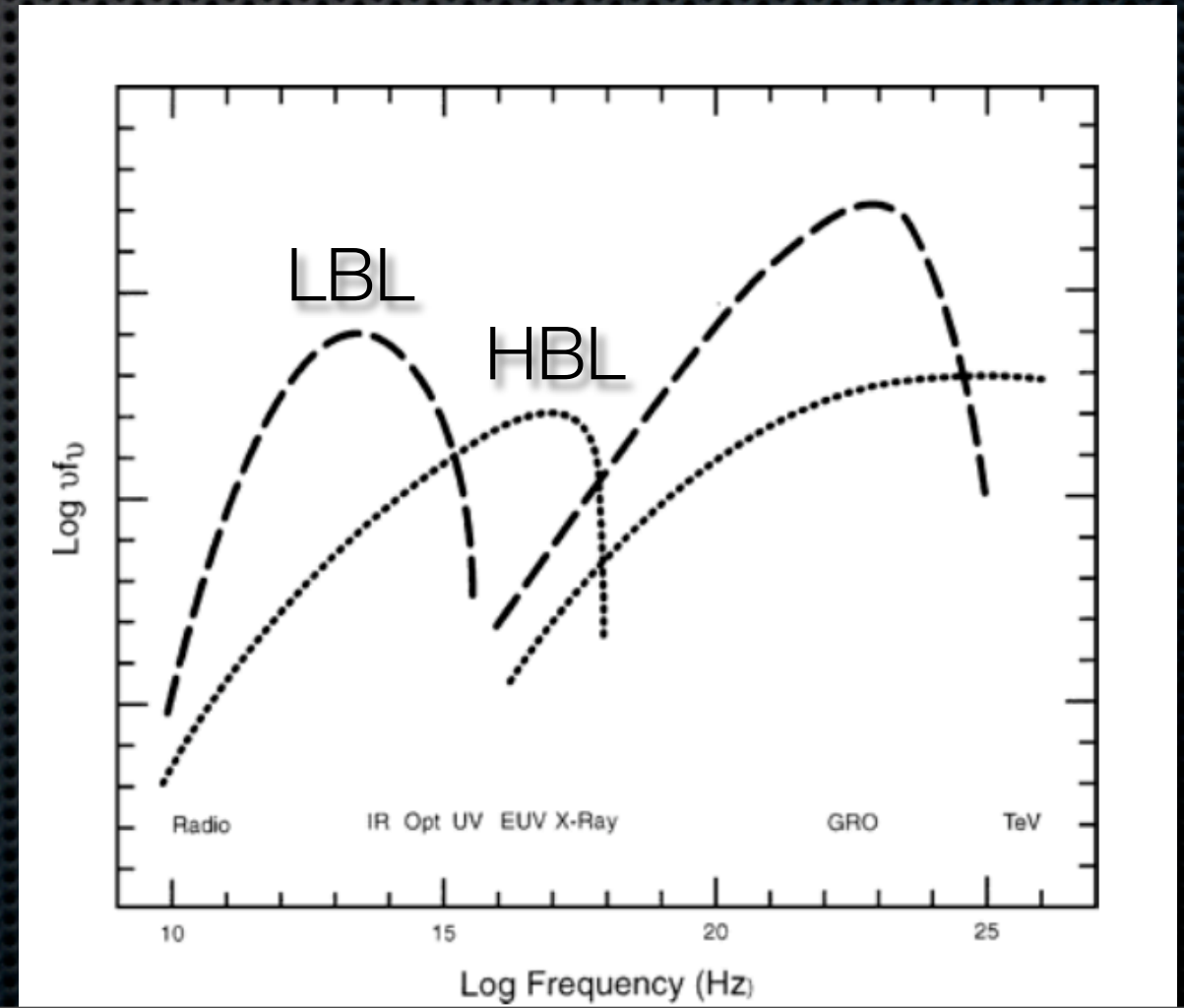
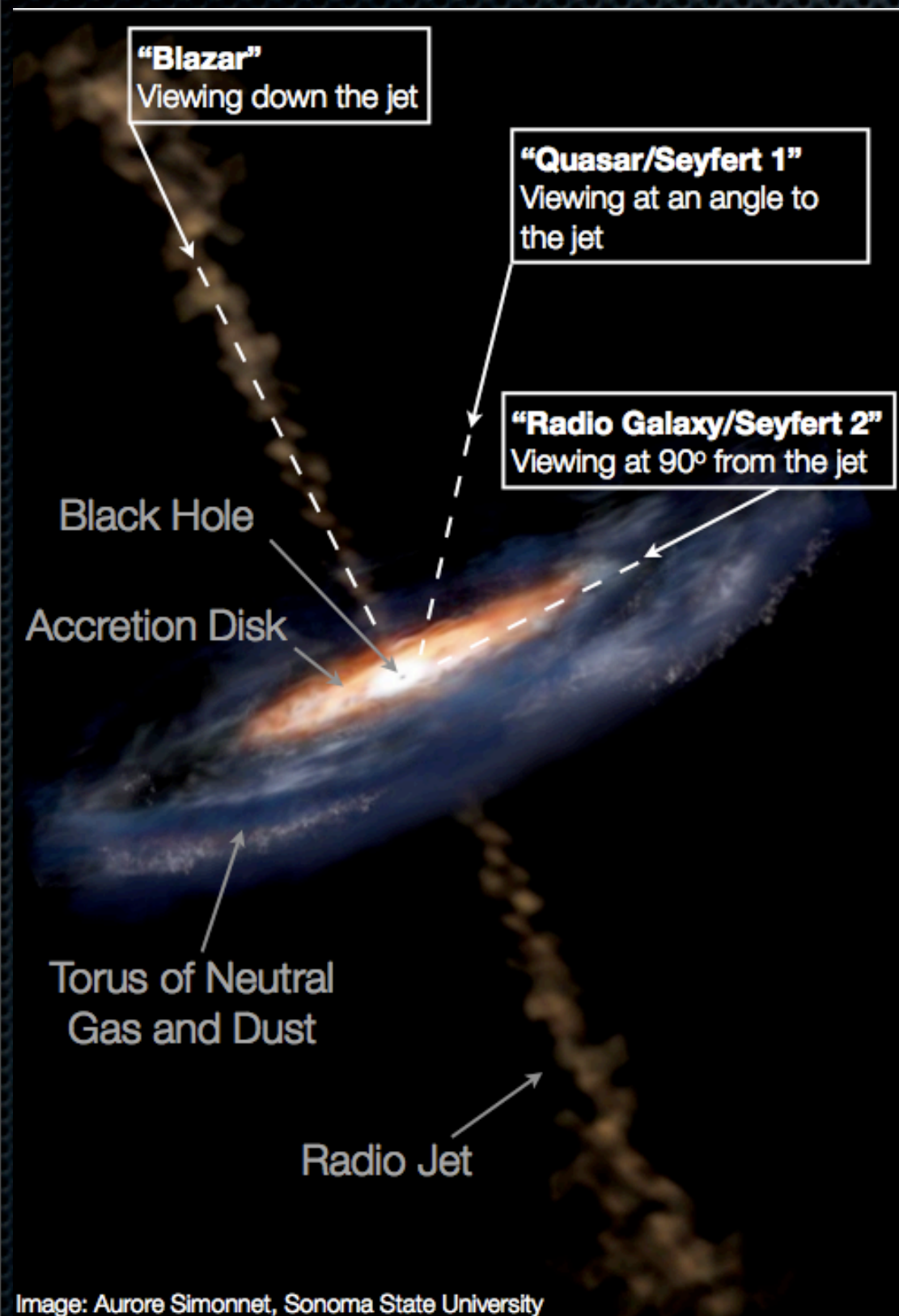
*-Mt. Hopkins, Az (1268 m a.s.l.)
Currently most sensitive TeV
instrument in operation*

Array Reconfiguration: 30% increase in Sensitivity



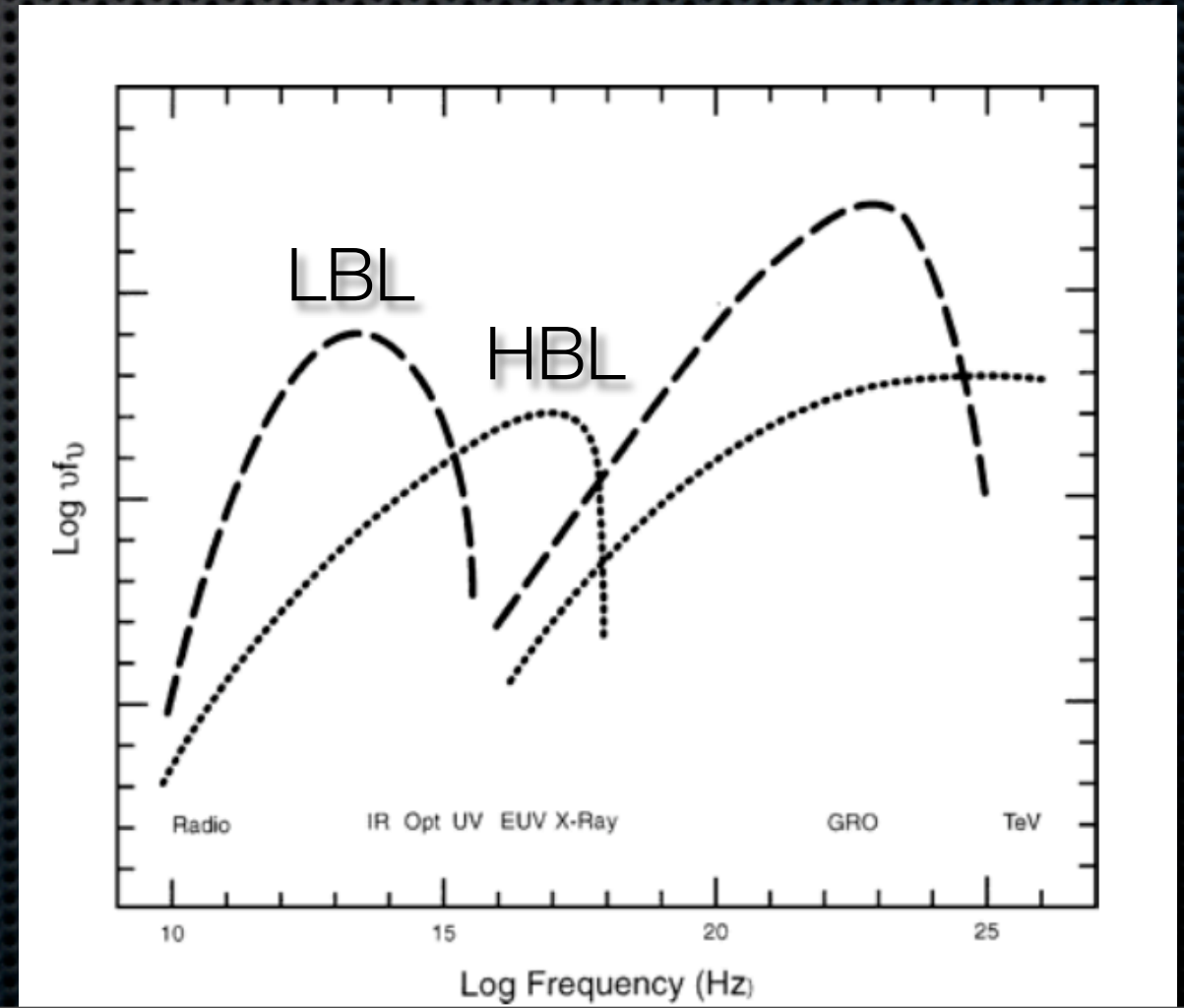
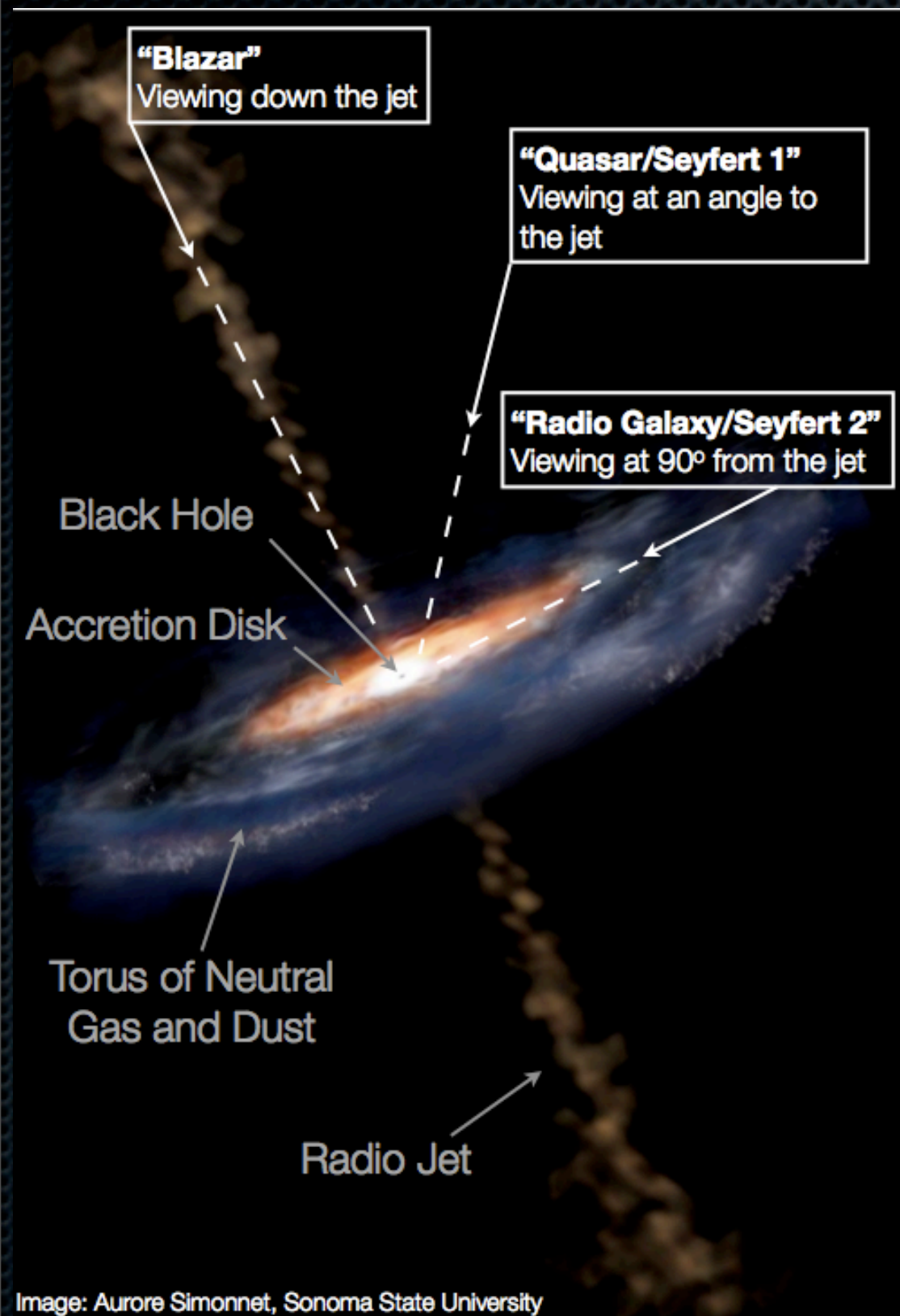
Blazars: "Down the Barrel" AGN (Smith)

-Central engine: $10^6 - >10^9$ Solar mass black hole



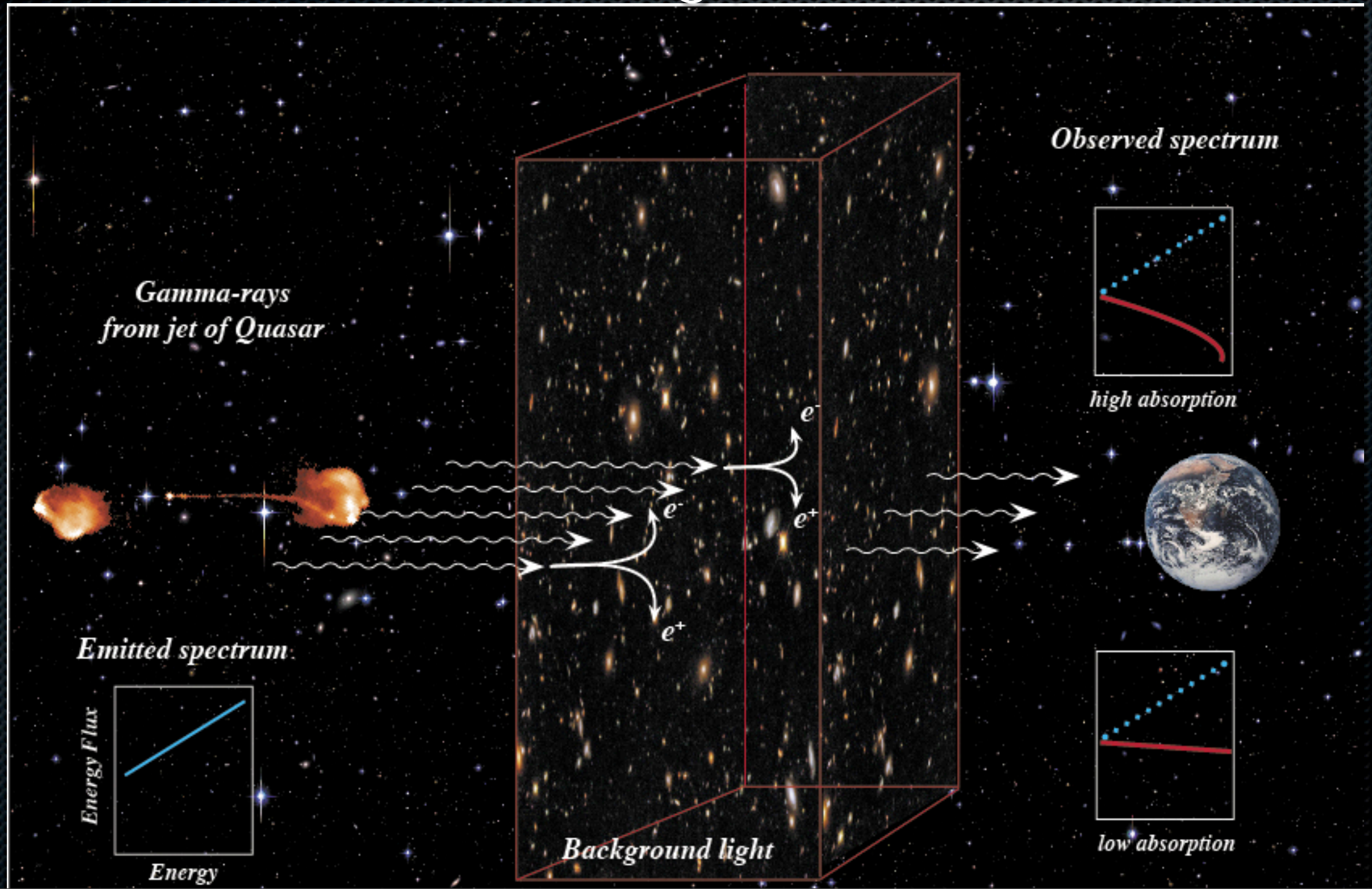
Blazars: "Down the Barrel" AGN (Smith)

- Central engine: $10^6 - >10^9$ Solar mass black hole
- TeV radiation (probably) created by SSC process.



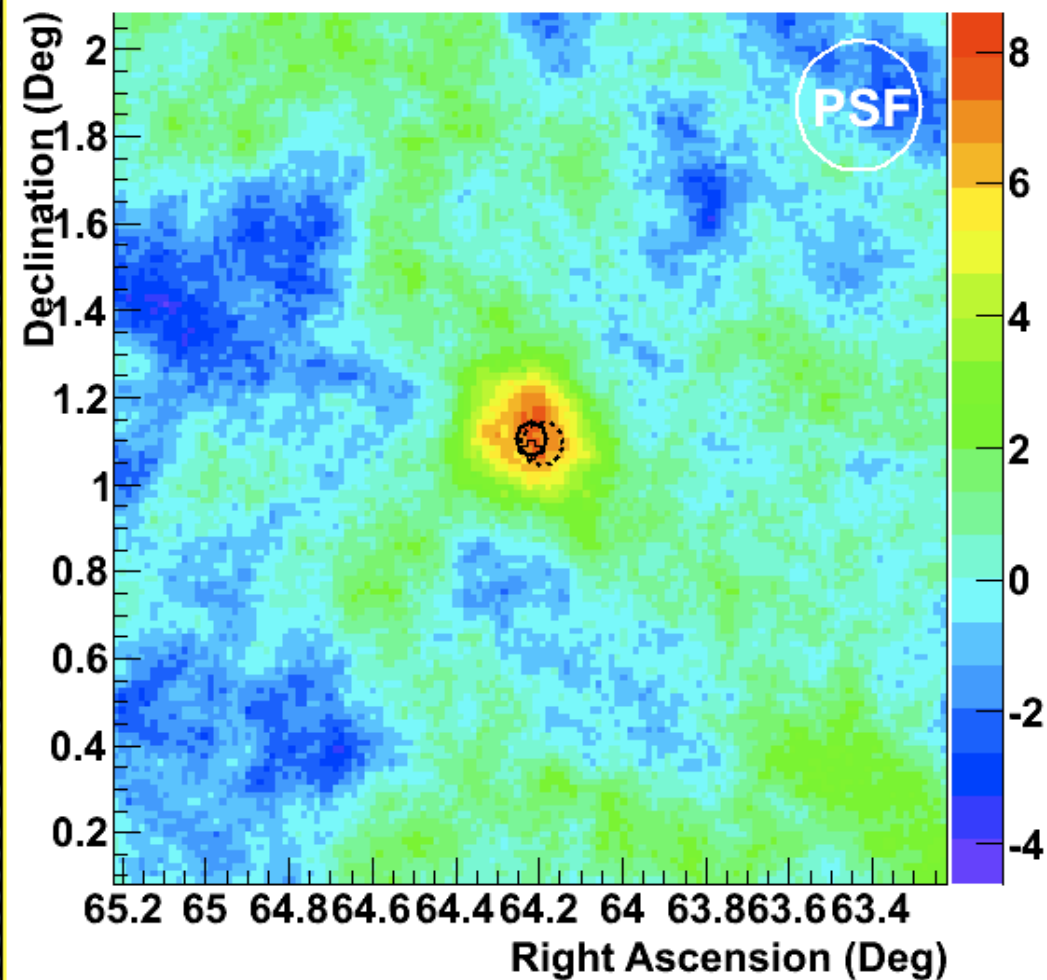
What can we do with AGN?

TeV attenuation strongly attenuated by EBL:

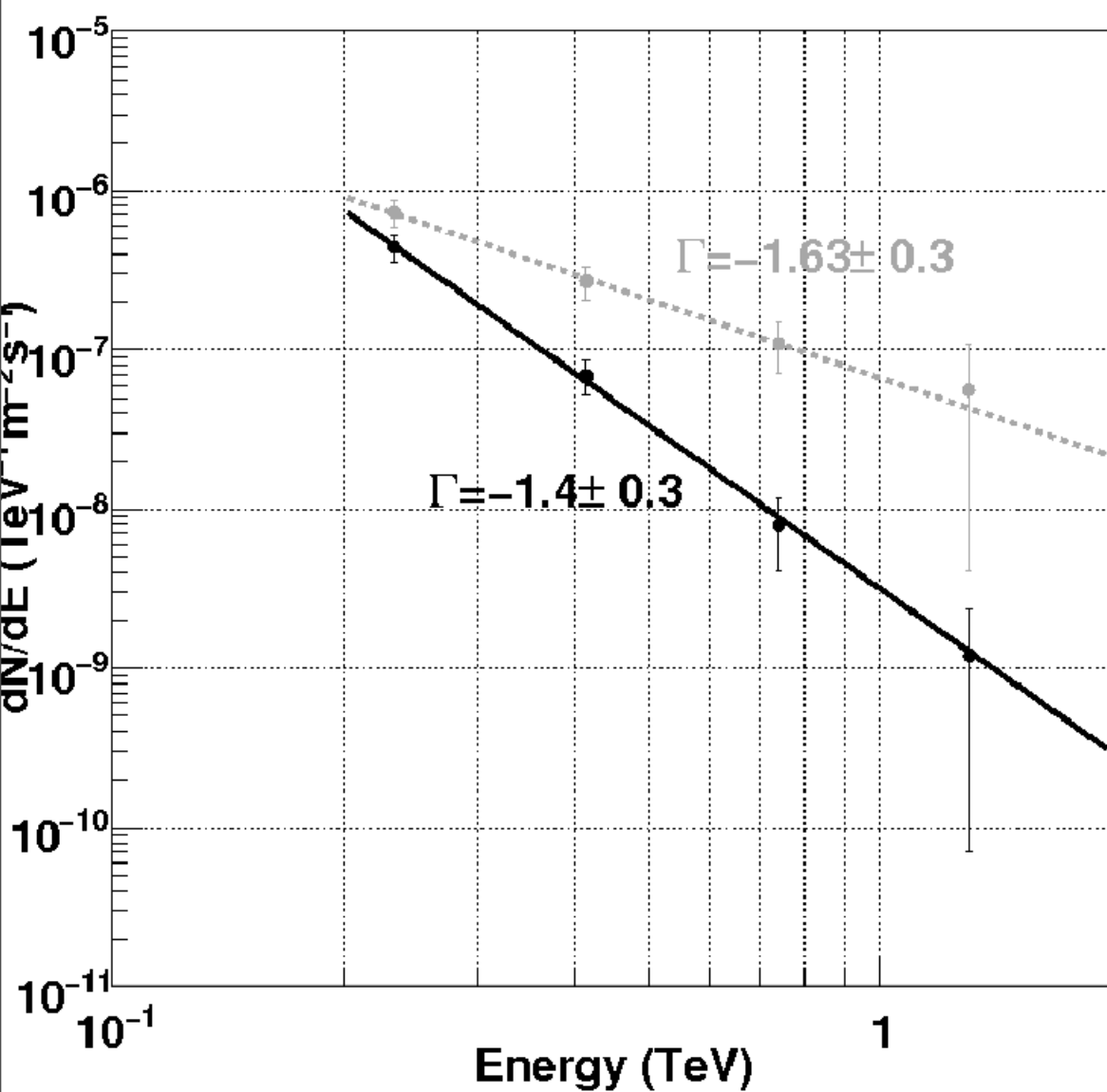


IES 0414+009

Significance Map (smoothed)

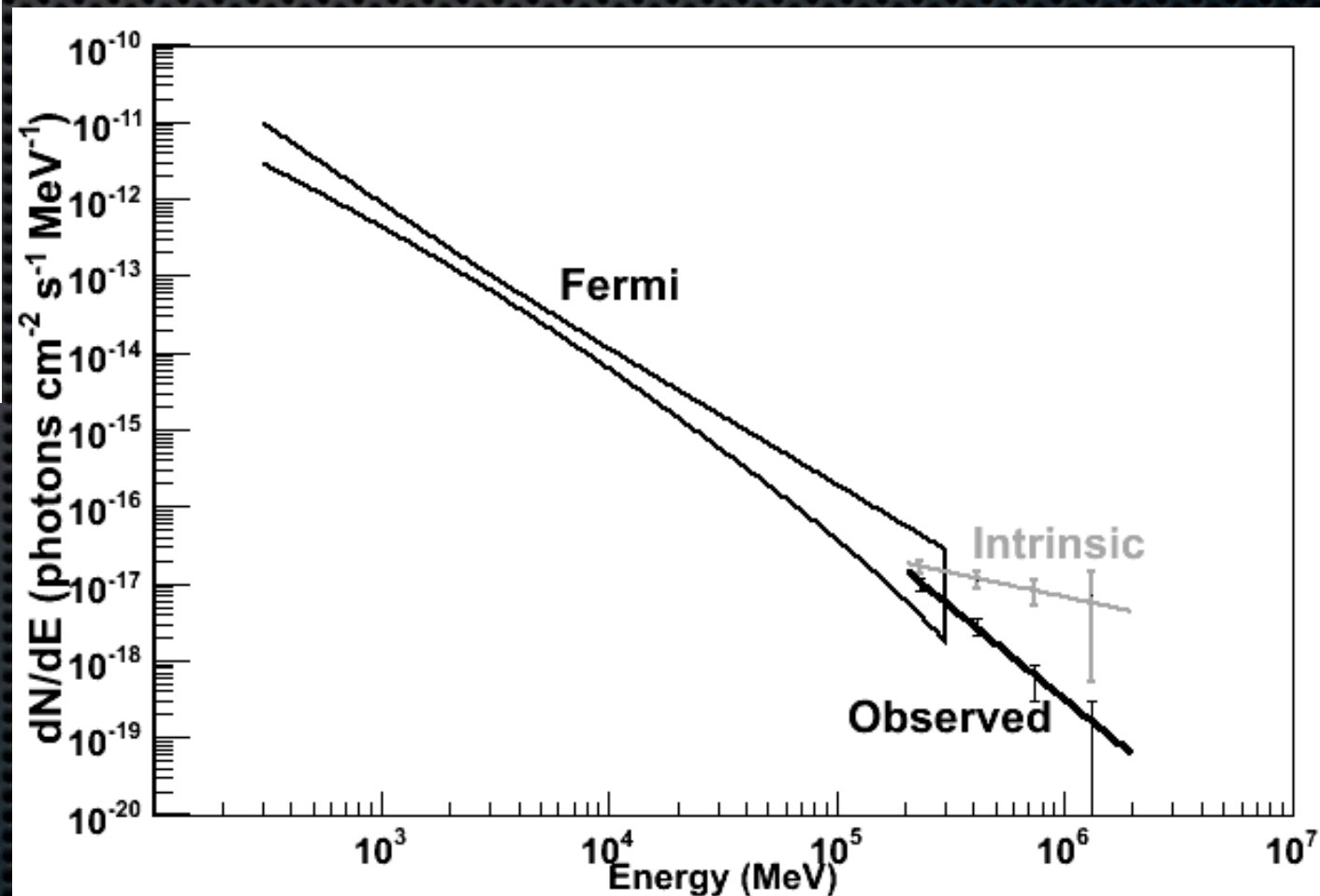


Very Distant ($z=0.287$) AGN
GeV Source (Fermi)
TeV Source (VERITAS/H.E.S.S.)



Using standard EBL model,
“deabsorbed” spectrum
violates known energetics of
AGN. Strong constraints on
EBL models.

Smith is primary author,
to be submitted to ApJ
in August



Dark Matter Searches (Wagner/Smith)

- WIMPs in mass range of 50 GeV-10 TeV are well motivated DM candidates
- Self annihilation of neutralino in this mass range leads to GeV-TeV gamma-rays
(spectral cutoff @ WIMP mass or "line" signature)
- FERMI, VERITAS+other IACTs well suited for search

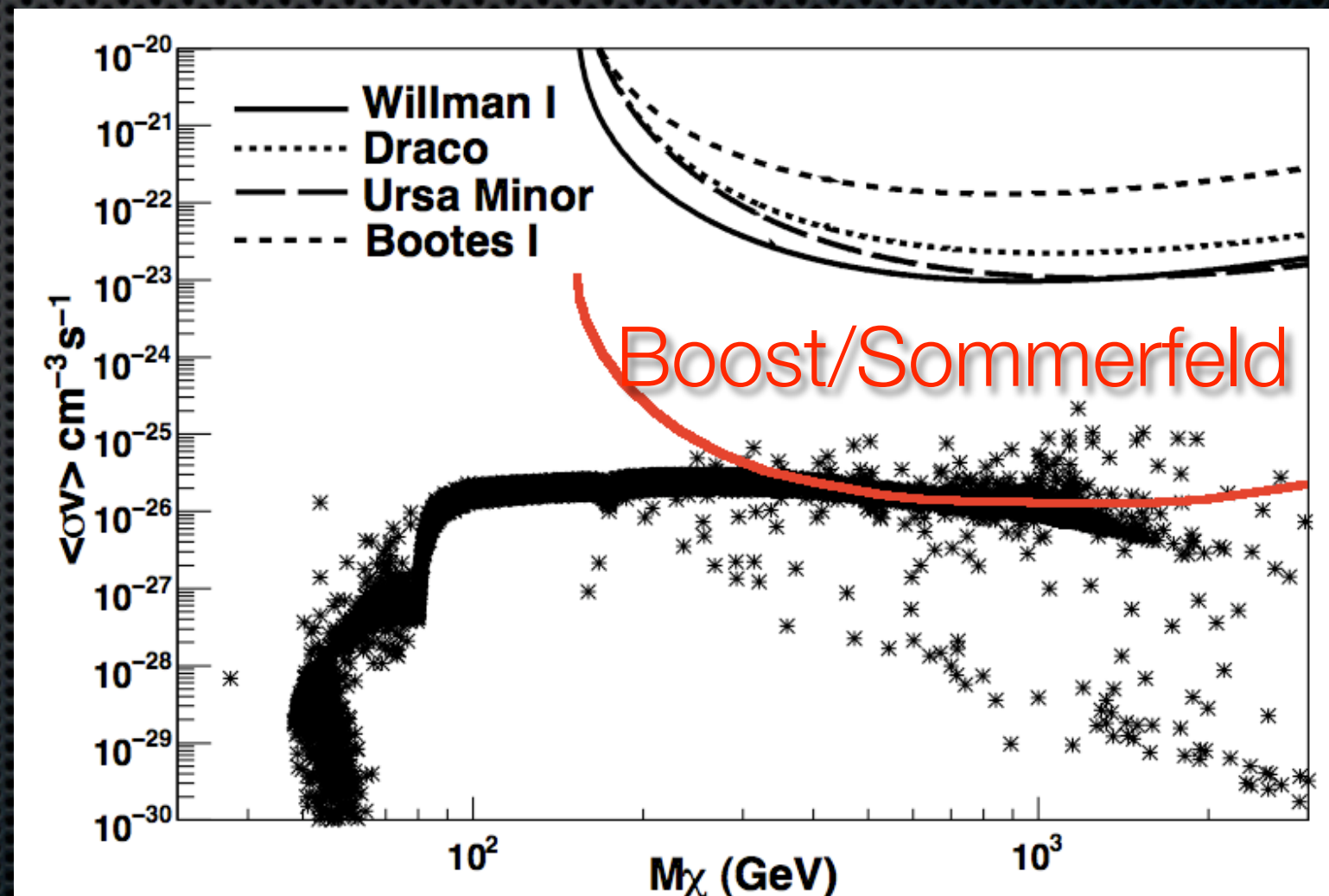


Dwarf Spheroidal Galaxies

- Very high mass/light ratio (DM dominated)
- Low astrophysical source confusion (can attribute any signal to DM)

-Conservative upper limits
(black), red indicates
possible particle/
astrophysics enhancements

Wagner lead publication-
accepted for publication in
ApJ June 2010



Acciari et al., 2010, to be submitted shortly...

Summary

- ANL VERITAS group is extremely active in hardware and science (trigger upgrade + 2 (and 3 upcoming) first authored collaborative publications.
- Contributing key science results
 - EBL Studies with high- z AGN
 - Dark Matter science
 - Galactic BH Physics with TeV Binaries
- Present success with only accelerate with upcoming upgrade of array